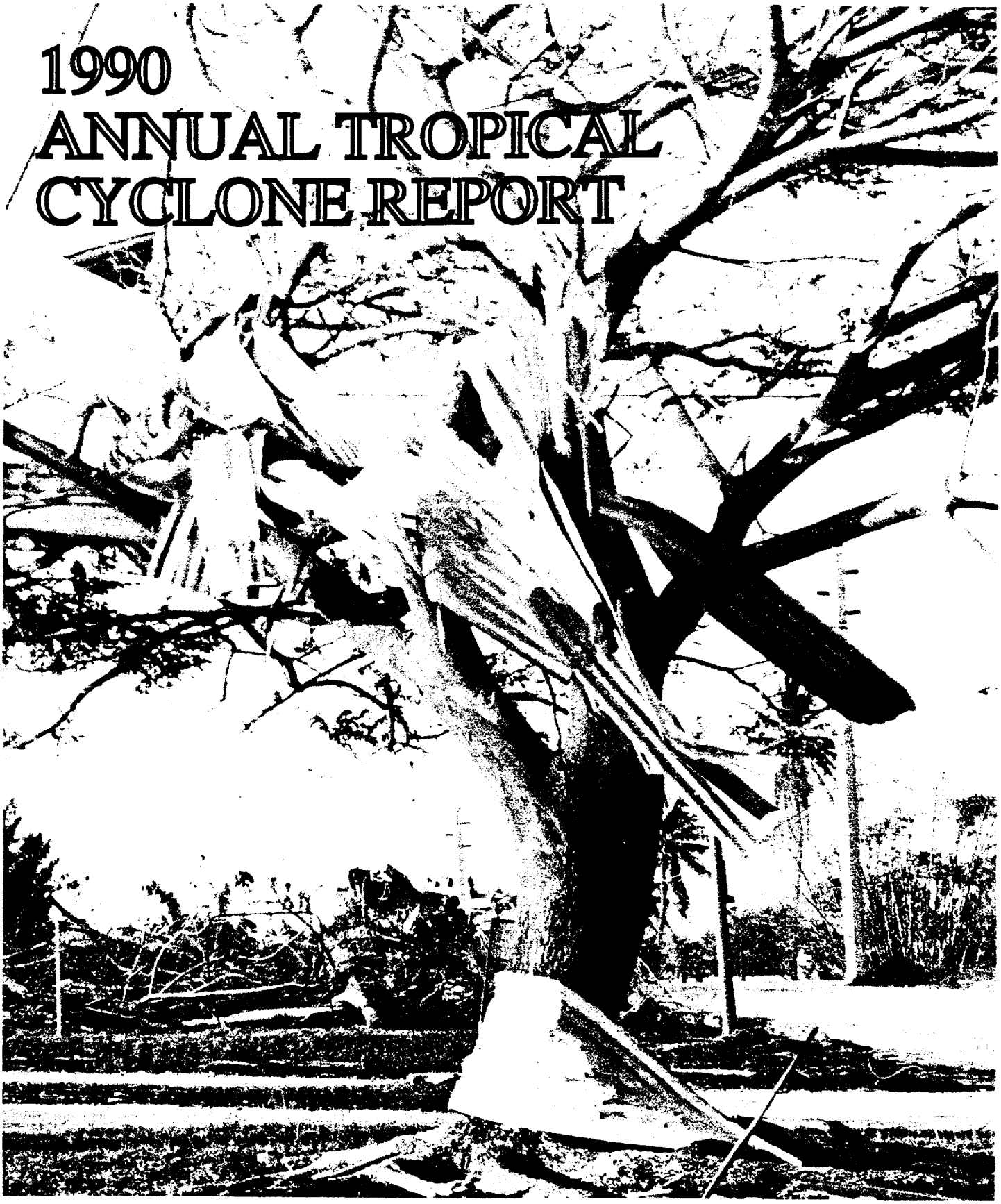
1990 ANNUAL TROPICAL CYCLONE REPORT



JOINT TYPHOON WARNING CENTER
GUAM, MARIANA ISLANDS

COVER CAPTION: Corrugated sheet iron roofing material wrapped around a splintered flame tree at commissary junction, Guam, bears mute testimony to the fury of Typhoon Russ' passage just four days before Christmas (Photo courtesy of NOCC/JTWC/Mr. F. H. Wells).

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FOREWORD

The Annual Tropical Cyclone Report is prepared by the staff of the Joint Typhoon Warning Center (JTWC), a combined Air Force/Navy organization operating under the command of the Commanding Officer, U.S. Naval Oceanography Command Center/Joint Typhoon Warning Center, Guam. JTWC was founded 1 May 1959 when USCINCPAC directed that a single tropical cyclone warning center be established for the western North Pacific region. The operations of JTWC are guided by CINCPACINST 3140.1T.

The mission of the Joint Typhoon Warning Center is multi-faceted and includes:

1. Continuous monitoring of all tropical weather activity in the Northern and Southern Hemispheres, from 180 degrees longitude westward to the east coast of Africa, and the prompt issuance of appropriate advisories and alerts when tropical cyclone development is anticipated.

2. Issuance of warnings on all significant tropical cyclones in the above area of responsibility.

3. Determination of requirements for tropical cyclone reconnaissance and assignment of appropriate priorities.

4. Post-storm analysis of significant tropical cyclones occurring within the western North Pacific and North Indian Oceans, which includes an in-depth analysis of tropical cyclones of note and all typhoons.

5. Cooperation with the Naval Oceanographic and Atmopheric Research Laboratory (NOARL), Monterey, California, on the operational evaluation of tropical cyclone models and forecast aids, and the development of new techniques to support operational forecast scenarios.

The JTWC staff constantly strives to improve the quality of the Annual Tropical Cyclone Report. Last year we sent out questionaires requesting recommendations for improvement. This 1991 edition of the Report contains changes in format and content that represent our attempt to incorporate your recommendations. We hope you find the changes beneficial. In any case, we would like to hear your comments.

Changes in this year's publication include: addition of an Executive Summary; movement of contractions and distribution to Appendices; western North Pacific write-ups included more synoptic details and photos; Tropical cyclone support summary expanded to include local studies; and tropical cyclone warning statistics as well as track and fix data are available upon request to be copied on to user provided diskettes.

JTWC has seen many changes over the past year. Perhaps the most significant was Air Force funding for the Det 1, 1WW Automation Project which should improve satellite reconnaissance support to JTWC.

Special thanks to: Captain Robert J. Plante for his significant contributions and support; the men and women of the 27th Communications Squadron, Operating Location Charlie and the Operations and Equipment Support departments of the Naval Oceanography Command Center, Guam for the high quality real-time satellite imagery support; personnel of the Pacific Fleet Audio-Visual Center, Guam for their assistance in the reproduction of satellite data for this report; the people of the Navy Publications and Printing Service Branch Office, Guam; Dr. Bob Abbey and the Office of Naval Research for their support to the University of Hawaii for the Post Doctorate Fellow at JTWC and their sponsorship of the largest typhoon experiment ever held in the western North Pacific, TCM-90; and Dr. Mark Lander for his training efforts and suggestions.

EXECUTIVE SUMMARY

The following information summarizes the 1990 tropical cyclone season in terms of JTWC's workload, reconnaissance support, forecast errors, and support to the Tropical Cyclone Motion (TCM-90) field experiment which was sponsored by the Office of Naval Research.

In 1990, JTWC issued 794 warnings on 32 tropical cyclones in the western North Pacific Ocean, 46 warnings on four in the North Indian Ocean and 298 warnings on 29 in the Southern Hemisphere, making it the center's busiest year in its history. The following summary shows JTWC's workload in each ocean basin and for the total area of responsibility (AOR):

	NWP	SH	NIO	AOR
Tropical cyclones	32	29	4	65
Days in warning status	165	98	15	239
Days in multiple warning status	54	29	0	83
Total Warnings	**794**	**298**	**47**	**1139**

Almost 5000 satellite fixes supported the tropical cyclone warning mission. In addition, several land-based radar stations in the western North Pacific provided nearly 1000 radar fixes. The NASA DC-8 research aircraft used in TCM-90 provided four aircraft fixes. The following table summarizes the reconnaissance support received at JTWC in 1990:

	NWP	SH	NIO	AOR
Satellite fixes	3140	1702	80	4922
Radar fixes	994	0	0	994
Aircraft fixes	4	0	0	4

JTWC's performance during 1990 resulted in the lowest 24-hr, the third lowest 48-hr, and the fourth lowest 72-hr forecast position errors ever in the Northwest Pacific. This performance was remarkable, considering that 65% of the tropical cyclones took recurving tracks. Of the 32 tropical cyclones in the western North Pacific, four were super typhoons, 17 were less intense typhoons, 10 were tropical storms and one was a tropical depression. 1990 also saw the second lowest intensity forecast errors ever at all verifying times. In the western North Pacific JTWC also reduced the false alarm rate in forecasting tropical cyclone development from 32% in 1989 to 9% in 1990, while increasing the probability of detection from 91% to 97%. The following statistical summary shows JTWC's forecast errors in each ocean basin and in the total AOR:

	NWP	SH	NIO	AOR
Position errors				
24hr	103nm	143nm	101nm	114nm
48hr	203nm	263nm	146nm	217nm
72hr	310nm	--------	185nm	305nm
Intensity errors				
24hr	10 kt	10 kt	9 kt	10 kt
48hr	16 kt	16 kt	24 kt	16 kt
72hr	20 kt	------	48 kt	21 kt

JTWC acted as the operations center for TCM-90. More than 30 research scientists from several countries worked closely with Typhoon Duty Officers and other JTWC personnel during the busiest part of the western North Pacific tropical cyclone season. The Center dedicated over 3000 man-hours in support of TCM-90, resulting in closer ties between operational forecasters and the research community. The resulting data base was the most complete and finest ever collected on western North Pacific cyclones and will support decades of tropical cyclone research.

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